DOCUMENT RESUME

ED 170 813 CS 502 518

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TITLE An Abstract of an Investigation of Innovation Variables in a Technology Inventory.
PUB DATE May 79
NOTE 19p.; Paper presented at the Annual Meeting of the International Communication Association (Philadelphia, Pennsylvania, May 1-5, 1979)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Employee Attitudes; Employer Employee Relationship; *Individual Characteristics; *Innovation; *Organizational Communication; Participant Characteristics; Science Programs
IDENTIFIERS *Communication Research

ABSTRACT

Employees of a large data processing corporation participated in a study designed to determine differences on a series of innovation variables between and among employee participants and nonparticipants in a technology inventory program. Three employee groups were distinguished: employees who participated in the technology inventory program, those who were aware of the program but chose not to participate, and those who were unaware of the program. A total of 473 employees completed a 40-item self-administered questionnaire that measured six innovation variables: technical dyadic communication, information seeking behavior, awareness of gatekeeper, tendency to risk, attitudinal evaluation of innovation atmosphere, and social behavioral evaluation of innovation atmosphere. Analysis of the results revealed that there were differences among the participant and nonparticipant groups and relationships among innovation variables, between categorical and innovation variables, and between attitudinal and behavioral variables. (Eleven tables of data are included.) (GT)

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An Abstract of

AN INVESTIGATION OF INNOVATION VARIABLES IN A TECHNOLOGY INVENTORY

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Presented at the Annual Conference of the
International Communication Association

Philadelphia, Pennsylvania
May 4, 1979

CS 502 518

Support for a portion of this research was supplied by a grant by the Control Data Corporation, Minneapolis, Minnesota. Research in applied communication to scientific and technical issues dealt within this report was supported by the Agricultural Experiment Station, University of Minnesota, Dr. Keith Huston, Director.

ABSTRACT

AN INVESTIGATION OF

INNOVATION VARIABLES IN A TECHNOLOGY INVENTORY

PURPOSE

Based on the review of literature, it is apparent that technology inventories have become somewhat commonplace in various organizations. Past investigators have isolated one or a combination of two innovation variables to determine their role or impact in the generation of new ideas. There has been no research that utilizes a series of innovation variables to determine if there are attitudinal and behavioral differences between those who submit ideas those who do not.

Based on the review, six variables have been identified as critical in the innovation process: (1) technical dyadic communications, (2) information seeking behavior, (3) awareness of gatekeeper, (4) tendency to risk, (5) attitudinal evaluation of innovation atmosphere, and (6) social behavioral evaluation of innovation atmosphere. These variables are central for understanding an inventory and how it serves as a linkage for management between awareness of the needs and the actual operations of the market place (Rosenbloom and Wolek, 1970). In short, because of innovative atmosphere and presence of certain "critical variables" were operative in past technology inventory assessments, there is a need to explore the dimensions in a more comprehensive fashion in future studies. For these reasons a study to measure the operation of variables and their effects in a technology inventory was conducted.

SUBJECTS

Subjects who participated in the study were randomly selected from approximately 35,000 of the company's employees. Approximately 550 of the

2,000 participants in a technology inventory program were randomly selected from the remaining 33,000. Stratification techniques were utilized to select a proportionate representative sample to include various levels of management. Three groups were involved in the survey: Group I consisted of employees who participated in the technology inventory called "Quest for Technology." Group 2 consisted of employees who were aware of the program but chose not to participate. Group 3 consisted of employees who were unaware of the program.

PROCEDURES USED IN THE STUDY

The study was conducted among United States employees of a multinational corporation whose primary area of business is data processing.

A. Instrument

A 40 item self-administered survey questionnaire (The Innovation Inventory Questionnaire, IIQ) was developed. Innovation variables, selected from past research, were used to measure the effects of the "Quest for Technology" program.

(1) Technical Dyadic Communication: Items included technical communication with immediate supervisors, co-workers within one's unit or department, co-workers outside one's unit or department, and people outside the organization. Past research reveals that informal interpersonal communication is important to facilitate innovation at the idea generation stage. (Zaltman, et al, 1973)

(2) Seeking Behavior: Items included seeking information via books, articles, attendance at workshops, number of college courses enrolled in during the past year and number of technical periodicals read during the past month. It has been confirmed that innovative people seek information from a wide variety of sources more frequently than do non-innovative people. (Knight, 1967)

(3) Awareness of Gatekeeper: The item requested subjects to indicate where they would submit a new idea. The effectiveness of the communication in an organization is enhanced with the existence of a "gatekeeper." Allen found that key individuals provide a linkage between users and sources to facilitate information flow. The awareness of a gatekeeper aids an innovator to identify the most efficient path or channel for ideas. (Allen, 1969)

(4) Risk Tendency: Items focused on how often respondents had ideas and how often they submitted ideas to the corporation. Shepard states that innovators must be prepared to take some risks and must follow through with ideas to insure their maintenance and advancement. (Shepard, 1967)

(5) Attitudinal Evaluation of an Innovative Environment: Items included importance of intrapersonal and interpersonal communication of ideas with superiors, importance of the impact of ideas, and importance of receiving acknowledgement for ideas. Andrews indicated that it is essential for management to insure a conducive and facilitative atmosphere for innovation and to assess the phenomena affecting the creative and innovative process. (Andrews, 1975)

(6) Behavioral Evaluation of an Innovation Environment: Items included superior's appreciation of technical suggestions, frequency of technical suggestions to superiors, utilization of ideas in practical situations, and acknowledgement from management for ideas. Items for categories five and six were developed from Patchen's index. (Patchen, 1965)

B. Research Questions

Two major questions are examined in the study: (1) Are there differences among those who participated in the inventory (Group 1, those who know about the inventory but did not participate (Group 2), and those who were unaware of the inventory (Group 3) on the six innovation variables? (2) What are the relationships among the innovation variables listed above, and between selected demographic variables and innovation variables, among "Quest for Technology" variables and innovation variables, and between attitudinal and behavioral "Quest for Technology" variables.

C. Statistical Analysis

Chi square analyses, Pearson Product Moment Correlation coefficient, multiple correlation coefficients, and one way analysis of variance were used to determine differences and relationships among and between groups. If overall significant differences occurred among means, post hoc analyses, using the Scheffé procedure, were computed between means to determine significant differences.

RESULTS OF THE STUDY

The results reported in Tables 1 through 7 indicate that there are significant differences among groups on the majority of items and all composite scores for each innovation variable. A summary of Scheffe results show that significant differences occurred between Group 1 (participant group) and Group 2 (chose not to participate group) on the following items: (1) seeking information through college courses scores, (2) awareness of gatekeeper scores, (3) ideas for improvement in the organization scores, (4) composite risk scores, (5) variety and change in job scores, (6) composite attitudinal evaluation, (7) superior appreciates technical suggestions scores and (8) composite behavioral evaluation scores.

Significant differences occurred between Groups 1 and 3 on (1) communication with co-workers scores, (2) composite seeking information scores, (3) seeking information through new books and articles scores, (4) seeking information through technical periodicals scores, (5) awareness of gatekeeper scores, (6) submitted ideas for new products (7) composite risk scores, (8) variety and change in job scores, (9) composite attitudinal evaluation scores and (10) all items on behavioral evaluation scores.

There were also significant differences between Groups 2 and 3: (1) seeking information through technical periodicals scores and (2) submitting ideas for new products.

Analyses of variances were also completed for the categorical demographic variable to determine if differences existed between and among groups on each composite innovation variable and the overall innovation scores. The results indicate significant differences ($< .05$) occurred (1) among level of management and technical dyadic communication, (2) among level of age and tendency to risk, (3) between awareness of gatekeeper and innovation atmosphere, and (4) between levels of management and number of ideas submitted and number of ideas accepted.

Table 8 reports the relationships between innovation variables for the participant group. Significant correlations occurred between (1) technical communication and seeking information scores, (2) technical dyadic communication and attitudinal evaluation scores and (3) attitudinal evaluation and behavioral evaluation scores.

Correlational analysis between categorical and innovation variables were computed for the participating group (see Table 9). There are significant positive correlations between:

1. Level of management and amount of technical dyadic communication.

2. Number of technical periodicals read and technical dyadic communication, seeking information and composite innovation scores.
3. Awareness of gatekeeper and innovative atmosphere and composite innovation scores.
4. Age and tendency to risk.
5. Number of college courses taken and seeking information.

There are significant negative relationships between:

1. Number of college courses taken and innovative importance.
2. Number of technical periodicals read and tendency to risk.

Multiple correlations for participants in the "Q for T" program were computed for each innovation variable (See Table 10). The analyses show that:

1. Innovative atmosphere and composite innovation scores were the best predictors of technical dyadic communication and seeking information.
2. Composite innovation and technical dyadic communication scores were the best predictors of innovative importance and innovative atmosphere.
3. Innovative atmosphere and technical dyadic communication were the best predictors of tendency to risk and composite innovation scores.

Correlational analyses were also completed to determine the relationships between "Q and T" variables and innovation variables. These results indicate that: (See Table 11)

1. Submittals not accepted correlates with technical dyadic communication, seeking information and composite innovation scores.
2. Submittals rewarded correlates with innovative atmosphere.
3. The value of the "Q and T" program correlates with innovative atmosphere.
4. Submittals accepted for 50 points, submittals accepted for 1000 points, and submittals rewarded do not correlate with any of the innovation variables.

The final correlational analysis was completed among "Q and T" variables and between attitudinal and behavioral "Q and T" variables. The results show that there are significant positive correlations between:

1. Number of submittals not accepted and submittals accepted for 50 points.
2. Submittals accepted for 50 points and submittals accepted for 1000 points.
3. Submittals evaluated fairly and submittals rewarded and value of the "Q and T" program.

Finally,analysis was completed to determine the best attitudinal "Q and T" predictors of behavioral "Q and T" variables. The results show that submittals rewarded was the best predictor of behavioral "Q and T" variables.

ASSESSMENT

The results reveal that there were differences among the participant group and nonparticipant groups and relationships among innovation variables, between categorical and innovation variables, and between attitudinal and behavioral Q for T variables, etc. In conclusion these

observations are made concerning the development of the instrument, the research design and participants in the sudy.

1. This was an exploratory field study in which several items developed from various instruments used in past research and pilot studies were conducted to determine differences between and among participant and nonparticipant groups on a series of innovation variables. Thus, based on past research and pilot studies, the instrument appears to have content (face) validity. More research is needed to determine the reliability, construct, concurrent and predictive validity of the instrument.

2. An Ex post Facto design was used to determine differences among groups. The sampling procedures were not equivalent. Group 1 (the participant group) was not stratified according to level of management and thus may have consisted of employees in upper level management positions. The second sample was initially selected by using level of management as a stratification variable and then developed into two groups: employees who knew about the program but did not participate and those who did not know about the program. Further analysis is needed to determine if composition of the groups are different. That is personality variables should be considered so that multivariate analyses could be completed.

3. Correlational analysis reveals that there were relationships among innovation variables and between categorical and innovation variables for both the composite and participant groups. Although the correlations were significant, the predictive power of the correlations account for only a small nonsignificant percentage of the common variance.

4. Only 473 out of the 1100 responded to the questionnaire which is a rather low return. Thus, any advancing of the program should include this point.

5. Although pilot tests were completed to determine the relevancy of items, more research should be completed to determine specific importance for tasks performed in the organization. In addition, new ideas for each innovation variable might be added to increase the reliability and validity of the instrument. Other organizations might be involved to create other instruments to measure and to increase the construct validity of the innovation variables. Through this process several instruments could be developed to measure each innovation variable.

6. A variety of research designs might be used to increase understanding of the innovation construct. For example, time series designs both in field and experimental studies might be used to trace the innovation process and to determine how the employees who play different roles in the organization interface to create and implement new technology. Other research might attempt to identify linkers and determine what innovation variables are utilized to increase new technology among members of different departments of the organization. Information mapping techniques might be used to show various communication processes that occur from the inception of an idea to its acceptance or rejection.

7. Interviews also should be completed with a random sample of the more than 50% that did not return the questionnaire. A content analysis of the information may increase the understanding of innovation processes.

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TABLE I

Technical Dyadic Communication among Groups

Items	F	P
1. Your Immediate supervisor	11.81	.001
2. Co-workers in your unit or department	7.92	.001
3. People in departments other than your own	18.20	.001
4. People outside the company	6.36	.002
. Composite	19.88	.001

Significant differences (.01) between groups 1 and 3 on item three and on composite scores

TABLE 2

Seeking Behavior among Groups

Items	F	P
5. New books and articles	20.00	.001
6. Attended workshops, special seminars in company	6.89	.002
7. Attended workshops, special seminars outside company	12.92	.001
Composite	26.77	.001

Significant differences (.001) between groups 1 and 3 on items 5 and composite scores.

TABLE 3

Seeking Behavior Items
Chi Square Analysis

Item	x^2	P
8. College Courses	21.79	.02
9. Technical Periodicals	135.56	.001

Significant Differences (.02) between groups 1 and 2 on item 8 and (.01) between groups 1 and 3 and 2 and 3 on item 9

TABLE 4

Awareness of Gatekeeper
Chi Square Analysis

Item	x^2	P
10. Gatekeeper	47.54	.001

Significant differences (.001) between groups 1 and 2 and 1 and 3

TABLE 5

Risk Tendency Variables

Items	F	P
11. Ideas for New Products	7.07	.001
12. Ideas for New Applications	9.81	.001
13. Ideas for Improvements	10.50	.001
14. Submitted ideas for new products	19.61	.001
15. Submitted ideas for new applications	14.57	.001
16. Submitted ideas for new improvements	13.96	.001
Composite	22.66	.001

Significant differences (.05) between group 1 and 2 on item 13, (.001) between groups 1 and 3 and 2 and 3 on item 14, and (.001) between groups 1 and 2 and 1 and 3 on composite scores

TABLE 6

Attitudinal Evaluation of Innovation Environment

Items	F	P
17. Discuss technical questions & suggestions	2.69	.06
18. Variety and change in job	6.49	.002
19. Discuss application of ideas	3.42	.03
20. Discuss utilization in situations	.32	.999
21. Receive acknowledgement for ideas	1.47	.001
Composite	6.99	.001

Significant differences (.05) between groups 1 and 2 and 1 and 3 on item 18, and at .01 level on composite scores

TABLE 7

Behavioral Evaluation of Innovation Environment

Items	F	P
22. Superior appreciates technical suggestions	10.85	.001
23. Frequence of technical suggestions	17.59	.001
24. Ideas utilized in practical situations	15.84	.001
25. Frequence of acknowledgment	5.31	.006
Composite	23.71	.001

Significant differences (.01) between groups 1 and 3 on all items and (.02) between groups 1 and 2 on items 22 and composite scores.

TABLE 8

Correlations Among Innovation Variables

N=269 DV	Technical Dyacom	Seekinfo	Tendency to Risk	Attitudinal Evaluation	Behavioral Evaluation
Technical Dyacom		.39**	.12	.19*	.07
Seekinfo			-.10	.08	.02
Tendency to Risk				-.14	.01
Attitudinal Evaluation					.55**
Behavioral Evaluation					

**=significance at the .005 level
*=significance at the .025 level

TABLE 9

Correlations between demographic and innovation variables
Group 1

N = 269 DV	L of M	L of E	Age	Sex	No. of CC	Tech Per	A of G
Dyacom	.18*	.01	-.01	.007	.03	.22*	.10
Seekinfo	.10	-.09	.02	.04	.16*	.39**	.06
Riskinov	-.06	.05	.18*	-.03	.00	-.21*	-.07
Oftenatt	.11	.02	.02	.03	-.13	.10	.26**
Imporatt	-.05	.03	.004	.04	-.19*	.04	.12
Inovtot	.15	-.02	-.01	.01	.08	.44**	.22**

** = significant at the .005 level
* = signifcant at the .025 level

Dyacom = Technical Dyadic communication
Seekinfo= Seeking Information
Riskinov=Tendency to Risk
Oftenatt=Innovation Atmosphere
Importatt=Innovation Importance
Inovtot=Total Innovation Score

TABLE 10

Multiple Correlations for Innovation Variables
Group 1

N = 269 DV	Dyacom R	Seekinfo R	Riskinov R	Oftenatt R	Imporatt R	Inovtot R
	Inovtot .73	Inovtot .58	Oftenatt .14	Inovtot .26	Inovtot .36	Dyacom .73
	Oftenatt .76	Oftenatt .63	Dyacom .21	Dyacom .34	Dyacom .47	Oftenatt .82
	Imporatt .78	Riskinov .65	Imporatt .22	Seekinfo .42	Seekinfo .54	Seekinfo .88
	Seekinfo .80	Imporatt .67	Inovtot .22	Riskinov .45	Oftenatt .54	Imporatt .90
	Riskinov .80	Dyacom .70	Seekinfo .22	Imporatt .45	Riskinov .54	Riskinov .91

.24 is needed for significance at the .001 level

TABLE 11

Correlations Between "Q for T" Variables and Innovation Variables

IV/DV	SNA	S-5	S-1	SEF	SR	PV
Dyacom	.19*	.11	.06	-.01	.04	-.01
Seekinfo	.25**	.10	.07	.06	.07	.09
Riskinov	.12	.07	-.01	-.08	.007	-.04
Oftenatt	-.07	.005	-.05	.17*	.10	.18*
Imporatt	-.11	.06	.06	.07	.11	.12
Inovtot	.28**	.13	.04	.03	.11	.08

** = significant at the .005 level
* = significant at the .025 level

SNA - submittals not accepted, S-5 = submittals accepted for 50 points, S-1 = submittals accepted for 1000 points, SEF = submittals evaluated fairly, PV = program value